

# Efficient Graphene/Silica-Functionalised Melamine Foam for Rapid Adsorption of Diesel Oil from Water

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## Priority Topic Area: Water and Sanitation

### Research Motivation

#### Diesel Oil Pollution



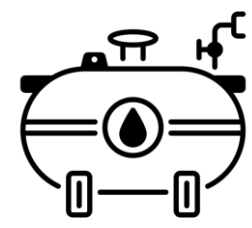
**> 38,000 tonnes**  
Oil spilled globally <sup>[1]</sup>

#### Sources:



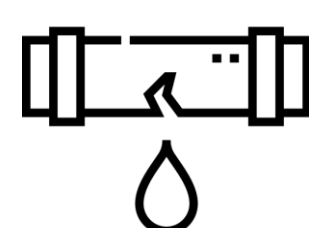
Marine vessels

**> \$30 billion**  
Annual cleanup cost <sup>[2]</sup>



Leaks from tank

**1million litre water**  
Polluted with 1 litre of oil <sup>[3]</sup>



Pipeline rupture

#### Solution:



#### Graphene/Silica Functionalised Foam (GSF)

- ✓ Improved hydrophobicity for enhanced oil uptake
- ✓ High flexibility and high surface area

### Objectives

- To develop a novel GSF and characterise its properties
- To evaluate the diesel oil adsorption performance and mechanism by GSF
- To evaluate GSF regenerability potential

### Methodology

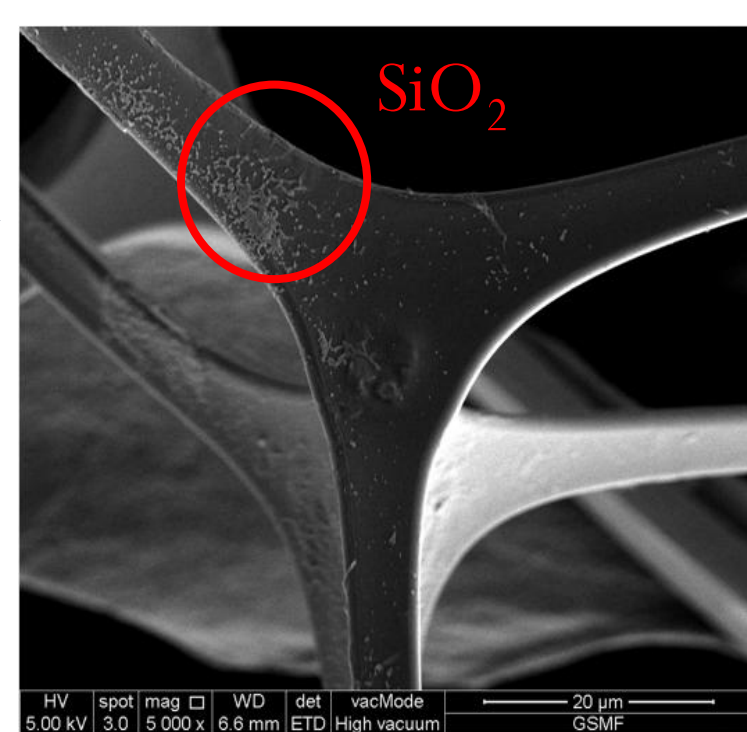


### Result & Discussion

#### Characterisation

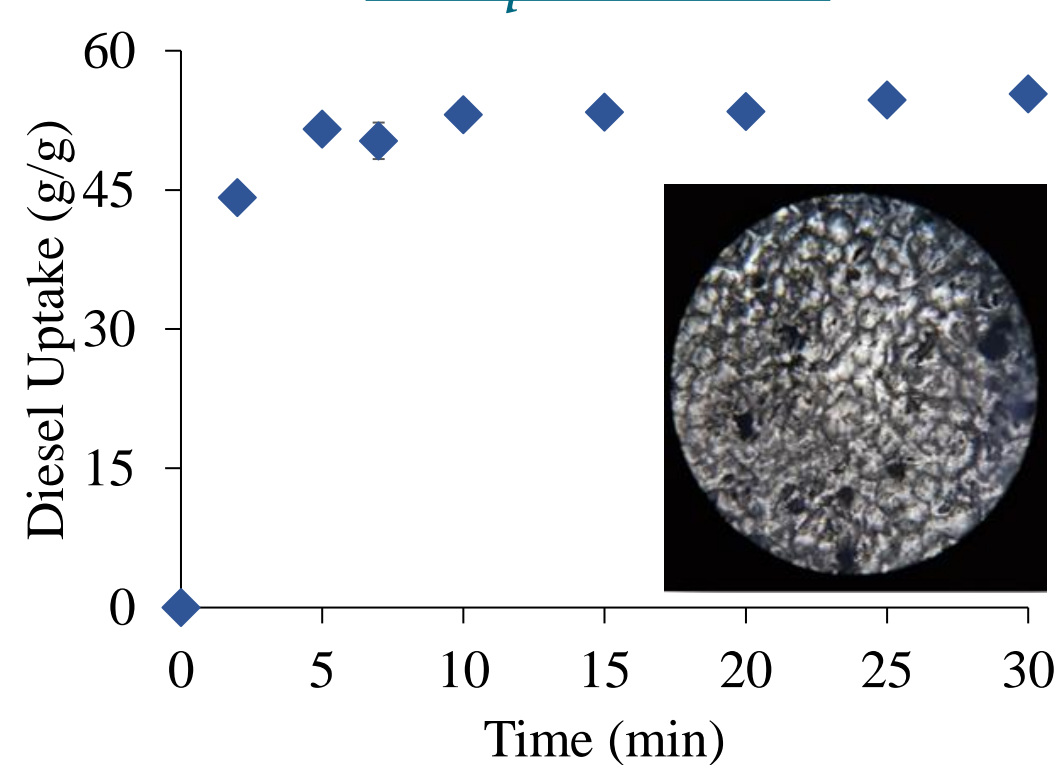


**GSF adsorbent**



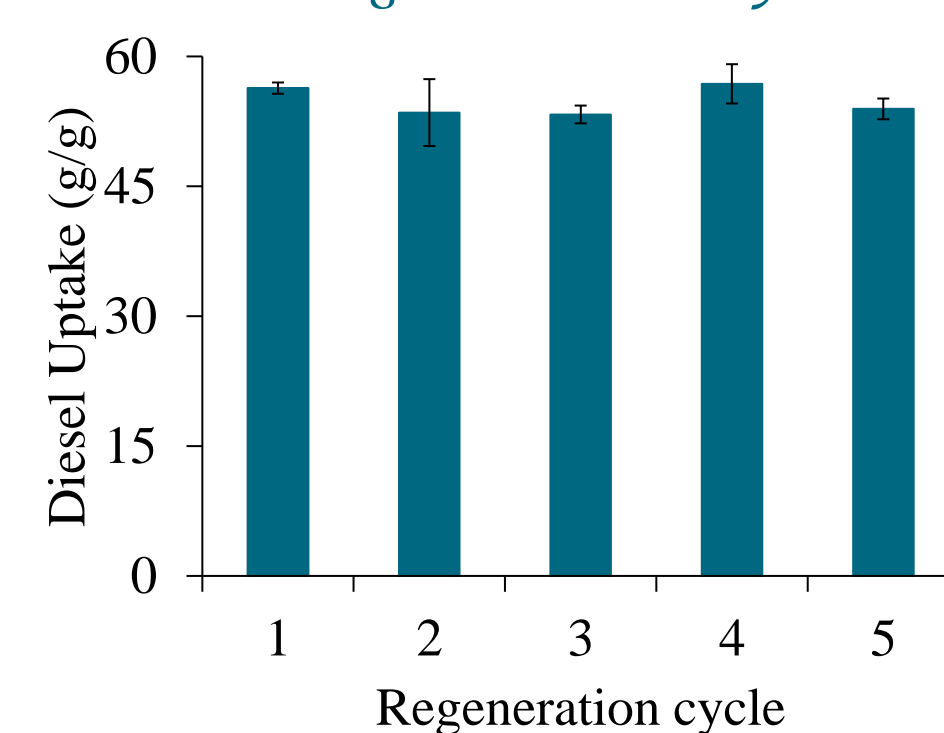
- ❖ Porous network anchored with SiO<sub>2</sub> nanoparticles
- ❖ Ultralight weight ( $\sim 20 \text{ mg/cm}^3$ )
- ❖ C=C is primary functional group

#### Adsorption kinetic



- ❖ Rapid adsorption process
- ❖ Successful diesel uptake into the pores/ binding sites of GSF
- ❖ Equilibrium capacity = 55.37 g/g

#### Regeneration study



- ❖ GSF is regenerable easily via mechanical compression
- ❖ High performance retention after 5 regeneration cycles

### Project Benefits

**6** CLEAN WATER AND SANITATION



- ❖ Rapid and efficient method for diesel cleanup

**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE



- ❖ Novel and regenerable material for industrial application

**14** LIFE BELOW WATER



- ❖ Floatable adsorbent for easy recovery and efficient regeneration

### Future Works



Process optimisation in enhancing diesel adsorption capacity



Investigate the efficiency of GSF in real-world diesel spill conditions (seawater/ freshwater)



Explore eco-friendly nanomaterials to enhance performance, sustainability and recyclability

#### References/Acknowledgements

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[1] ITOPF (2025). Oil tanker spill statistics 2024. ITOPF Ltd, London, UK.

[2] BBC News (2010) BP oil spill: The environmental impact one year on. Available at: <https://www.bbc.com/news/business-10770252> (Accessed: 23 March 2025).

[3] European Commission (2022) Waste oil. Available at: [https://environment.ec.europa.eu/topics/waste-and-recycling/waste-oil\\_en](https://environment.ec.europa.eu/topics/waste-and-recycling/waste-oil_en) (Accessed: 23 March 2025).